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GB 2329695 A
DE 020207189 U1
US 6348913 B1
DE 029716864 U1
US 6353429 B1
US 6340966 B1

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(71) Applicant(s):
Samsung Electro-Mechanics Co., Ltd.
(Incorporated in the Republic of Korea)
314 Maetan-3-dong, Paldal-gu, Suwon-si,
Kyunggi-Do 442-743, Republic of Korea

(72) Inventor(s):
Sang-Sin Han
Dong-Hoon Kang

(74) Agent and/or Address for Service:
Dummett Copp
25 The Square, Martlesham Heath,
IPSWICH, Suffolk, IP5 3SL,
United Kingdom

(54) Abstract Title: Click feature for a computer mouse wheel or wheel button

(57) An optical or ball mouse has a wheel 300 rotatably supported by two wheel shafts extending from either side of the wheel, and serrations 304 formed on an inside portion of the external surface of a first wheel shaft 302. In one embodiment (not illustrated), a locking projection at a wheel shaft support engages the serrations for a wheel click sensation. The wheel is set between the light emitting/receiving elements 124,125 too detect radial openings 306 and ribs 308 of the wheel. In another embodiment, the locking projection 146 is provided at a side surface of the upper portion of a wheel base 140. The wheel base rotatably supporting the first wheel shaft 302, and is mounted for vertical movement between ribs 114. A wheel button switch 123, two mouse button switches 121,122 and the light emitting/receiving elements are mounted on a printed circuit board (PCB). Two support ribs 112 extend upwardly to rotatably support the second wheel shaft. A spring 310 upwardly biases the wheel. The serrations and locking projection may be made of the same material to reduce abrasion and the need for grease.

Fig. 2

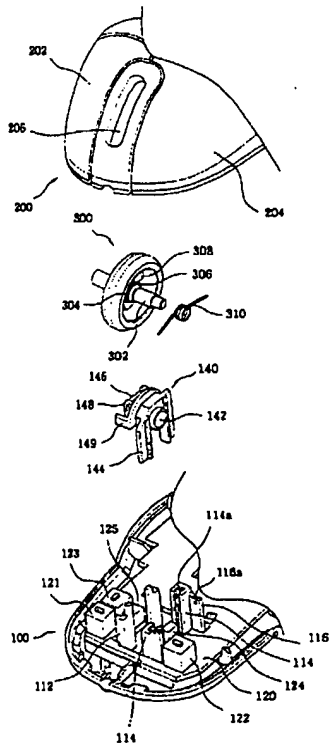

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Fig. 1

PRIOR ART

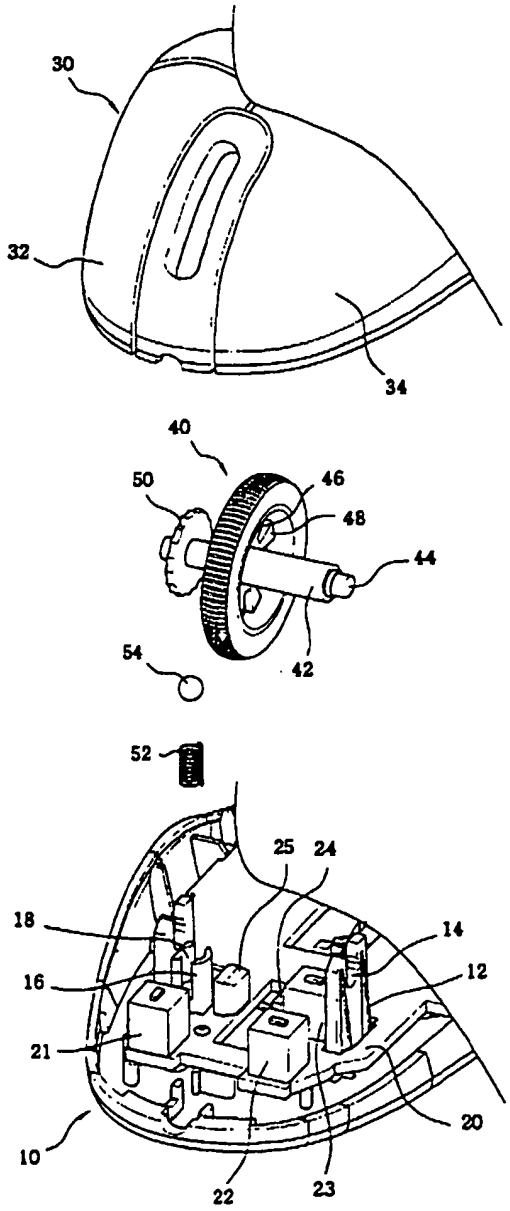
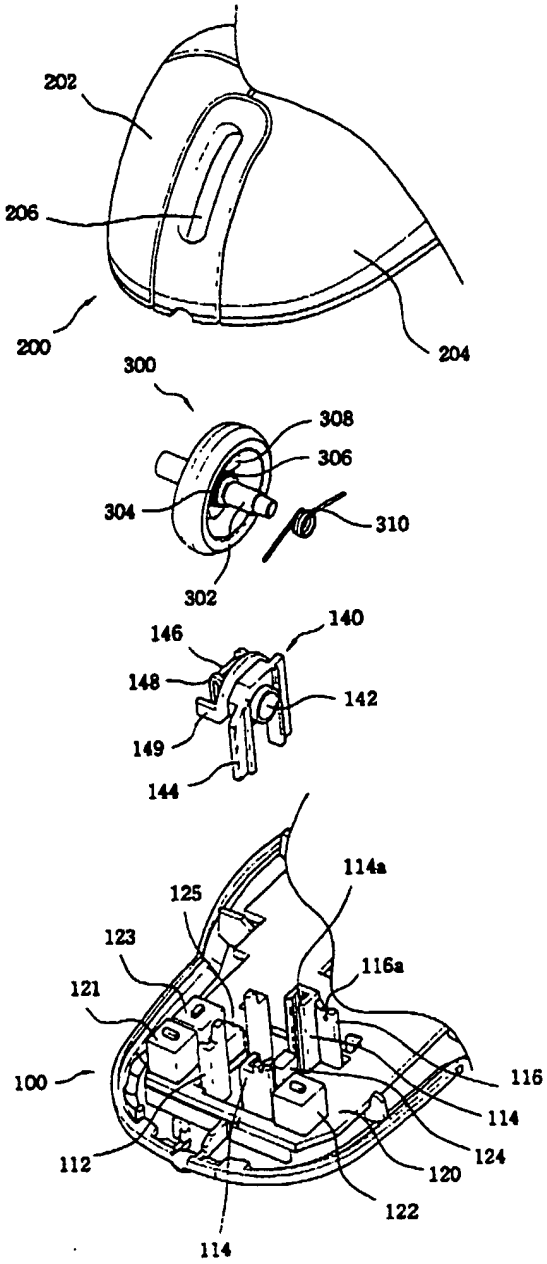


Fig. 2


202
206
200
204
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308
306
304
310
302
140
146
148
142
149
144
114a
125
123
116a
121
116
100
114
112
124
120
122
114

Fig. 3

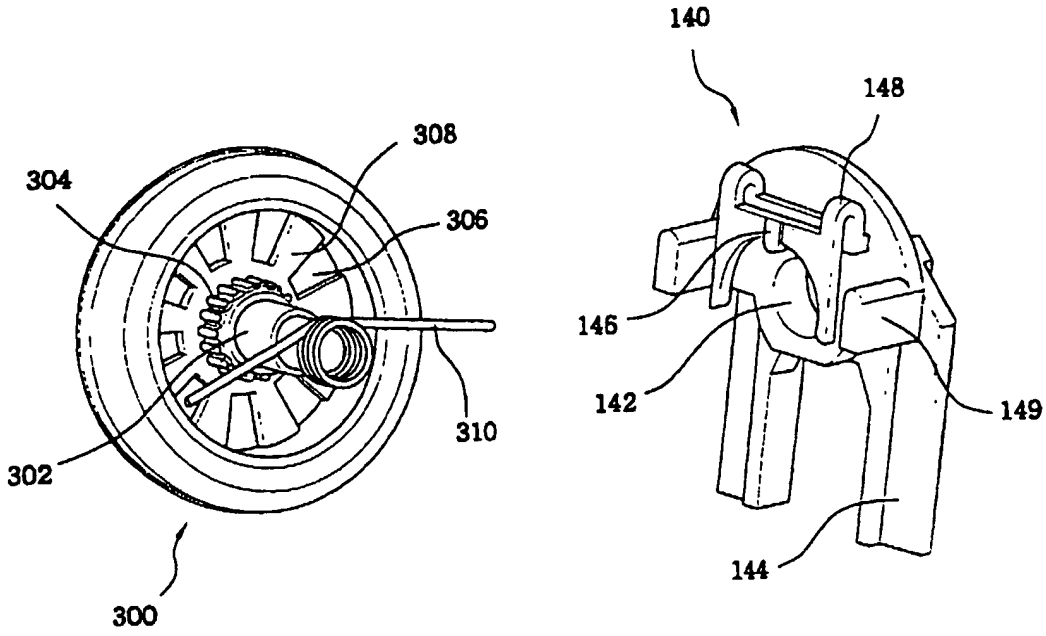


Fig. 4

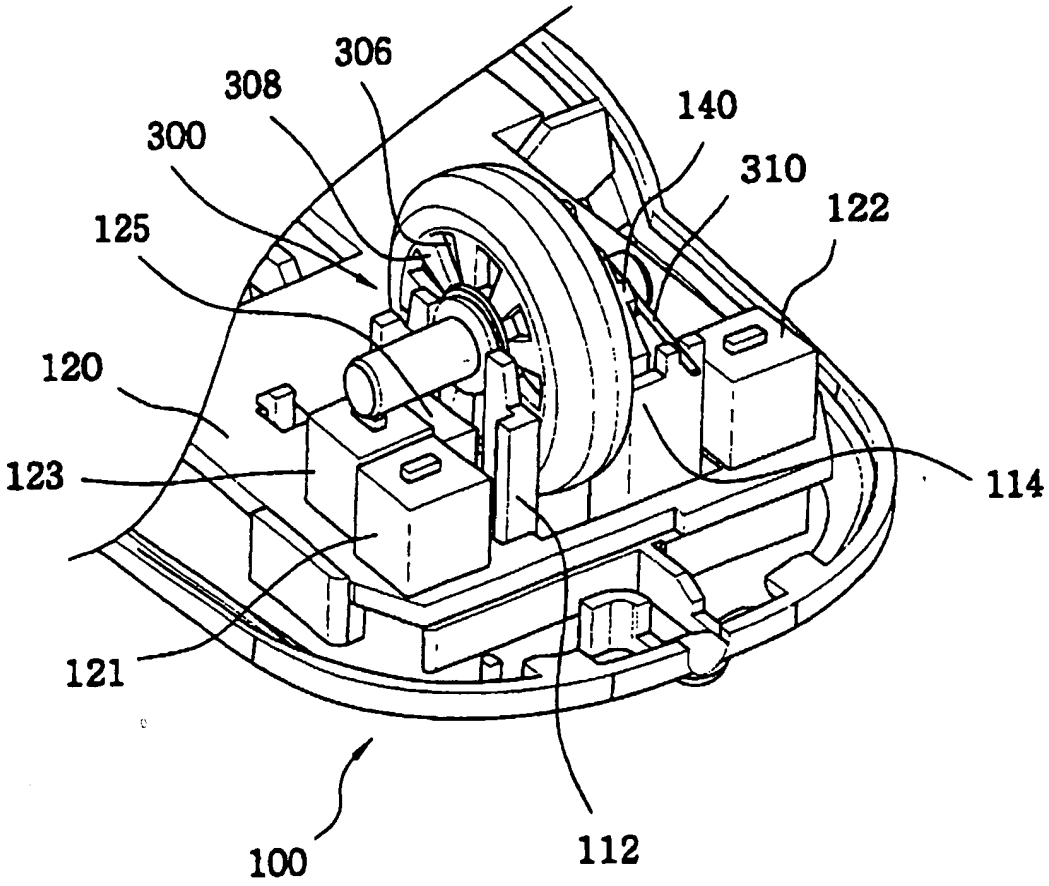
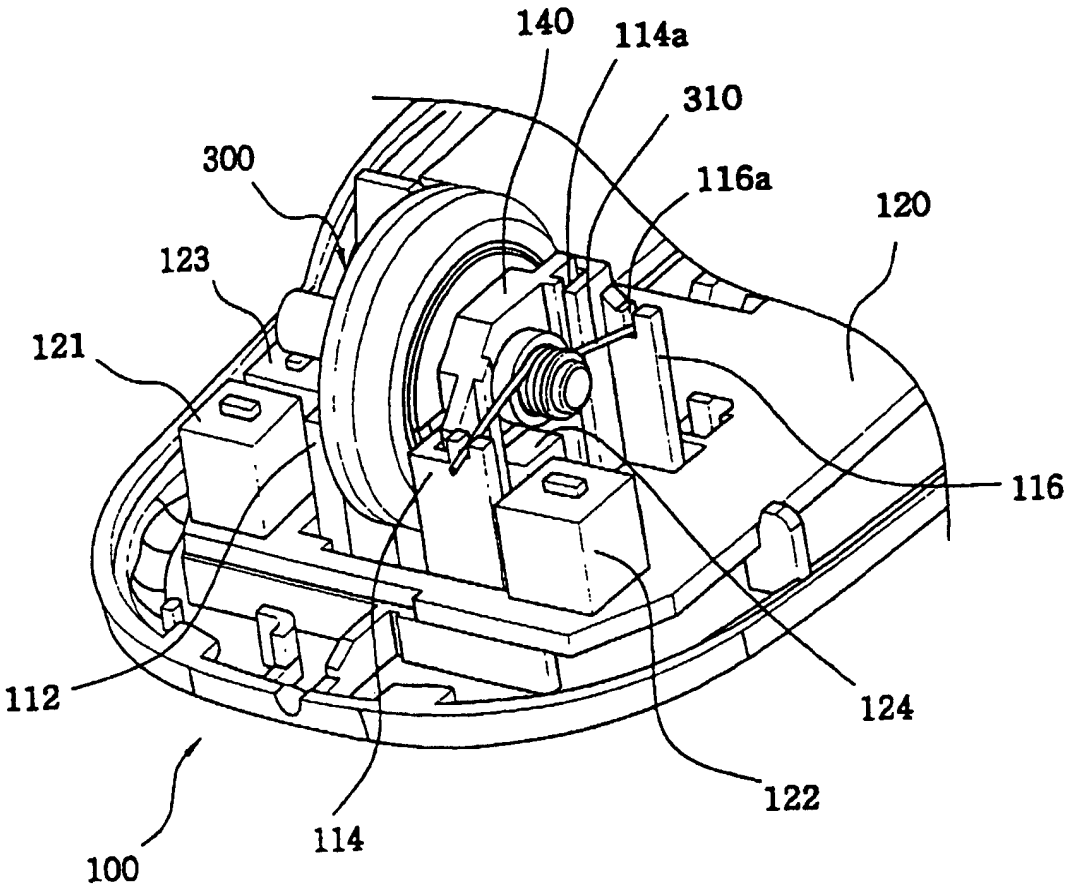


Fig. 5



MOUSE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to a mouse, and more particularly, to a mouse, which improves the construction and method of assembling a wheel provided in the mouse, thus allowing a user to further sense the movement of the wheel while rolling it with a user's finger.

Description of the Prior Art

As well known to those skilled in the art, a mouse is an integral part of a computer. The mouse is a kind of pointing device, and is different from a keyboard which is used for directly inputting data into the computer. That is, the mouse is used for indicating a program on a display screen and is clicked to execute the selected program.

Such a mouse is classified into two types, that is, a ball mouse and an optical mouse. The ball mouse is operated by rolling a round ball provided in the mouse. On the other hand, the optical mouse is operated by sensing its movement using light. Recently, the ball mouse has developed into the optical mouse.

A modern mouse, either the ball mouse or the optical

mouse, is designed such that a wheel is rotatably mounted at a position between two buttons provided on the top of the mouse. In this case, when rolling the wheel with a user's finger, a scroll bar is moved in a rolling direction of the wheel.

That is, when an entire document or other information is not displayed on one screen in Windows operating system, the modern mouse is designed to move the scroll bar by rolling the wheel with a user's finger, different from the typical mouse designed to adjust the scroll bar by pointing with the mouse.

Fig. 1 shows an example of a conventional mouse. The construction for and method of assembling the conventional mouse will be described hereinafter with reference to Fig. 1.

The conventional mouse is designed such that its cover 30 is detachably mounted to a body 10. A wheel 40 is rotatably mounted at a predetermined position on the front portion of the body 10. The wheel 40 is projected from the cover 30 in such a way as to be exposed.

Wheel shafts 42 horizontally extend outward from both side surfaces of the center portion of the wheel 40. Each of the wheel shafts 42 is stepped at its ends in such a way as to be integrated with end rods 44. In this case, each rod 44 is smaller in diameter than the other parts of the wheel shafts 42. A serrated disc 50 is provided at a predetermined position on the external surface of one of the two wheel shafts 42.

Further, nine openings 46 and nine radial ribs 48 are alternately formed on the central portion of the wheel 40 at regular intervals.

Two support ribs 12 upwardly extend from the body 10 while being spaced apart from each other by the summed length, except for the end rods 44, of the two wheel shafts 42. Seat grooves 14 are formed on the top portions of the support ribs 12, so that the end rods 44 of the wheel shafts 42 are seated in the seat grooves 14, respectively.

A spring support member 16 upwardly extends from the body 10, and is mounted at a position corresponding to the serrated disc 50 of the wheel 40. An insert groove 18 of a predetermined depth is vertically formed on the spring support member 16. A spring 52 and ball 54 which are made of steel, are sequentially inserted into the insert groove 18. The ball 54 biases the serrated disc 50 upwardly by the elasticity of the spring 52, so a clicking sound is made due to the engagement of the ball 54 and the serrations of the serrated disc 50 whenever a user rolls the wheel 40.

A printed circuit board (PCB) 20 is mounted on the body 10. A light emitting element 24 and a light receiving element 25 are mounted on the PCB, and are spaced apart from each other by a gap wider than the width of the wheel 40 such that the wheel 40 is set on the PCB at a position between the two elements 24 and 25. When light is emitted from the light

emitting element 24, the light intermittently passes through the openings 46 of the wheel 40 and is received by the light receiving element 25. That is, only when the openings 46 are arranged between the light emitting and receiving elements 24 and 25 while rolling the wheel 40, the light passes through the wheel 40 and is received by the light receiving element 25. At this time, a display screen is scrolled by the mouse. In this case, since the ball 54 engages with the serrations of the serrated disc 50, the openings 46 are rotated one by one.

Further, a wheel button switch 23 is mounted at a position between the support ribs 12 provided on the PCB 20 such that the wheel button switch 23 is pressed by one of the wheel shafts 42 when the wheel 40 is pressed. Left and right mouse button switches 21 and 22 are mounted on the front portion of the PCB 20 and pressed by left and right mouse buttons 32 and 34, respectively, which are provided on the cover 30 such that they are pressed by a user.

When a user rolls, with his or her finger, the wheel 40 of the conventional mouse constructed in this way, the ball 54 continuously engages with the serrations of the serrated disc 50 one by one, so the user continues to sense the wheel 40 clattering. When the wheel 40 is rotated by the user with the ball 54 engaging with the serrations of the serrated disc 50, the openings 46 are rotated one by one. At this time, light intermittently passes through the wheel 40. The display

screen is scrolled in response to the passage of the light.

However, the conventional mouse has a problem that the serrated disc 50 is made of plastic while the ball 54 is made of steel, so the serrated disc 50 is rapidly worn out, thus reducing sensitivity of the wheel 40 when the wheel 40 is rotated.

In order to reduce the abrasion of the serrated disc 50 and allow the mouse to be smoothly operated, grease for plastic may be applied between the ball 54 and the serrated disc 50. But, it is complicated to apply the grease between the ball 54 and the serrated disc 50. In the case where the grease drops to the PCB 20, the grease may penetrate other components mounted to the PCB 20, thus causing a malfunction of the mouse.

Further, since the spring 52 and the ball 54 are inserted into the insert groove 19 of the spring support member 16 by means of tweezers, a manufacturer must take great care when assembling said components, thus resulting in low assembling efficiency. In addition, the conventional mouse needs many components, so its manufacturing cost is high.

Furthermore, the conventional mouse has a large wheel structure, thus causing low space utilizing efficiency.

SUMMARY OF THE INVENTION

Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a mouse, which has a wheel with a simple construction, thus increasing assembling efficiency, reducing its manufacturing cost, and which is designed to minimize the abrasion of serrations generated when rolling the wheel, thus maintaining excellent sensitivity of the wheel.

In order to accomplish the above object, the present invention provides a mouse, comprising a body having a printed circuit board on its bottom, with a wheel button switch, two mouse button switches and light emitting and receiving elements being mounted on the printed circuit board; a cover covering the body, and provided with two mouse buttons corresponding to the two mouse button switches; a wheel set between the light emitting and receiving elements, with two wheel shafts horizontally extending outward from center portions of both side surfaces of the central area of the wheel, with serrations formed around the external surface of a first wheel shaft on an inside portion of the wheel shaft, a plurality of openings and radial ribs alternately formed on the central area of the wheel at regular intervals; a wheel base mounted on the body for rotatably supporting the first one of the two wheel shafts, and provided at a side surface of an upper portion thereof with a locking projection, the

locking projection engaging with the serrations, with a tension rib supplying elasticity to the locking projection; two support ribs upwardly extending from the bottom of the body, and spaced apart from each other by a predetermined gap to rotatably support a second wheel shaft; and a spring for upwardly biasing the wheel.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is an exploded perspective view of a conventional mouse, and shows the construction of a wheel included in the mouse;

Fig. 2 is an exploded perspective view of a mouse according to the present invention, and shows the construction of a wheel included in the mouse;

Fig. 3 is an enlarged perspective view showing the wheel and a wheel base, respectively, which are included in the mouse of this invention;

Fig. 4 is a left perspective view of the wheel mounted in the mouse; and

Fig. 5 is a right perspective view of the wheel mounted

in the mouse.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference should now be made to the drawings, in which the same reference numerals are used throughout the different drawings to designate the same or similar components.

Fig. 2 is an exploded perspective view of a mouse according to the present invention, and shows the construction of a wheel included in the mouse. Fig. 3 is an enlarged perspective view showing the wheel and a wheel base, respectively, which are included in the mouse of this invention. Figs. 4 and 5 are left and right perspective views of the wheel mounted in the mouse, respectively.

As shown in the drawings, the mouse of this invention is designed such that its cover 200 is detachably mounted to a body 100. A wheel 300 is mounted at a predetermined position on the front portion of the body 100. In this case, the wheel 300 is projected from the cover 200 in such a way as to be exposed. A user may roll the wheel 300 by touching the exposed portion of the wheel 300 using his/her finger, in order to rotate sc the wheel 300 about first and second wheel shafts 302.

A printed circuit board (PCB) 120 is mounted on the body 100. Right and left mouse button switches 121 and 122 are

mounted on the front portion of the PCB 120. Light emitting and receiving elements 124 and 125 are provided on the PCB 120 such that the wheel 300 is positioned between the light emitting and receiving elements 124 and 125. A wheel button switch 123 is provided on the PCB 120 in such a way as to be perpendicular to the wheel shaft 302.

The cover 200 covers the body 100, and is provided on its front portion with right and left buttons 202 and 204 corresponding to the right and left button switches 121 and 122. A longitudinal wheel hole 206 is provided between the right and left buttons 202 and 204 in such a way that the wheel 300 is set in the hole 206 and exposed to the outside through the hole 206.

The first and second wheel shafts 302 horizontally extend outward from the center portions of both side surfaces of the central area of the wheel 300. Serrations 304 are formed around the external surface of the first wheel shaft 302 at its inside portion. A plurality of openings 306 and radial ribs 308 are alternately formed on the central area of the wheel 300 at regular intervals.

It is preferable that the number of openings 306 is nine, the number of radial ribs 308 is nine, and the number of serrations 304 is eighteen. That is, the eighteen serrations 304 are moved one by one while respectively and alternately corresponding to the nine openings 306 and the nine radial

ribs 308, during a single rotation of the wheel 300. Of course, it is possible to change the numbers of the serrations 304, the openings 306 and the radial ribs 308.

The first wheel shaft 302 is rotatably supported by a wheel base 140, while the second wheel shaft 302 is rotatably supported by two support ribs 112. The wheel base 140 is detachably held by two leg holding ribs 114. The two leg holding ribs 114 upwardly extend from the bottom of the body 100. The support ribs 112 upwardly extend from the bottom of the body 100.

The wheel base 140 includes a shaft hole 142 for receiving and rotatably supporting the first wheel shaft 302, and two legs 144 extending at its both side ends. The leg holding ribs 114 are provided on the body 100 and each have a fitting groove 144a. The legs 144 of the wheel base 140 are fitted into the corresponding fitting grooves 144a of the leg holding ribs 114 such that the wheel base 140 is detachably held in the leg holding ribs 114.

The two support ribs 112 are spaced apart from each other by a predetermined gap. The second wheel shaft 302 is set between the two supports ribs 112 and is seated on the top surface of the wheel button switch 123.

The wheel base 140 is provided at a side surface of its upper portion with a locking projection 146. The locking projection 146 engages with the serrations 304, and has

elasticity provided by a U-shaped tension rib 148. Two support projections 149 are provided on a surface of the wheel base 140 at opposite ends such that the locking projection 146 is positioned between the two support projections 149, and are in contact with a side surface of the wheel 300, thus preventing an unexpected movement of the wheel 300.

The wheel 300 is also upwardly and elastically biased by a spring 310.

In order to hold the spring 310 in the mouse, a projecting piece 116 is formed at a position of each of the leg holding ribs 114, and is provided on its top surface with a spring seat groove 116a. The spring 310 is fitted over the wheel shaft 302, with both ends of the spring 310 respectively seated in the spring seat grooves 116a of the projecting pieces 116, thus elastically and upwardly biasing the wheel 300.

The mouse of this invention may be held by the two wheel shaft support members in place of the wheel base 140 and the support ribs 112, without affecting the functioning of this invention. In this case, the mouse with a wheel rotatably supported by two wheel shafts has serrations formed around the external surface of one of the two wheel shafts at an inside portion of the wheel shaft. A locking projection engaging with the serrations is provided at one of the two wheel shaft support members in such a way as to have elasticity. The

locking projection is preferably connected to the upper portion of the wheel shaft support member through a tension rib, thus providing the desired elasticity.

The assembly, operation and effect of the mouse according to this invention will be described in the following.

First, in order to mount the wheel 300 on the PCB 120, the first wheel shaft 302 is inserted into the shaft hole 142 of the wheel base 140, and the spring 310 is then fitted over an end of the first wheel shaft 302.

Thereafter, the legs 144 of the wheel base 140 are inserted into the fitting grooves 116a of the leg holding ribs 114. At this time, both ends of the spring 310 are respectively seated in the spring seat grooves 116a. Meanwhile, the second wheel shaft 302 is held between the two support ribs 112 such that it is seated on the wheel button switch 123.

While a user rolls, using a his or her finger, the wheel assembled in this way, the locking projection 146 engages with the serrations 304, so the user may feel the engagement of the locking projection 146 and the serrations 304. At this time, since the tension rib 148 gives elasticity to the locking projection 146, the locking projection 146 vertically and elastically moves according to the shape of the teeth of the serrations 304.

Whenever the locking projection 146 continuously engages with the serrations 304 while making a clicking sound, the openings 306 and radial ribs 308 are rotated one by one. At this time, the light emitted from the light emitting element 124 intermittently passes through the wheel 300, and is received by the light receiving element 125. In this case, the display screen is scrolled in response to the passage of light.

When the wheel 300 is rotated, the support projections 149 of the wheel base 140 are in contact with a side surface of the wheel 300, thus preventing an unexpected movement of the wheel 300.

Further, when the wheel 300 is pressed, the second wheel shaft 302 moves downwardly while pressing the wheel button switch 123. On the other hand, when the wheel 300 is released, the second wheel shaft 302 is elastically returned to its original position by the restoring force of the spring 310.

In the mouse of this invention, assembled and operated in this way, the serrations 304 of the wheel shaft 302 and the locking projection 146 of the wheel base 140 are made of the same material, thus increasing the sensitivity as well as remarkably reducing the abrasion of the wheel, in comparison with a conventional mouse designed such that its plastic serrated ring is in contact with a steel ball. Therefore,

regardless of a repeated operation of the mouse of this invention over a lengthy period of time, the sensitivity of the wheel is not deteriorated and a desirable sensitivity is always maintained.

Since it is not necessary to apply grease between the serrations 304 and the locking projection 146 in order to reduce the abrasion of the wheel, the mouse is assembled simply.

Further, this invention provides a mouse, which needs a smaller number of components in comparison with a conventional mouse, thus increasing assembling efficiency and reducing its manufacturing cost, and which is designed such that the serrations 304 are formed at an inside portion of the first wheel shaft 302, thus reducing the size of the wheel 300, therefore having high space utilizing efficiency, being variously designed, and being used for both ball mouse and optical mouse.

As described above, the present invention provides a mouse, which is capable of remarkably reducing the abrasion of serrations formed on a wheel shaft, thus maintaining the sensitivity of the mouse, and which has more excellent sensitivity in comparison with a conventional mouse, and which has a simple construction, thus reducing its manufacturing cost and increasing assembling efficiency, and which has a wheel structure of a small size, thus increasing its space

utilizing efficiency.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

WHAT IS CLAIMED IS:

1. A mouse, comprising:

a body having a printed circuit board on a bottom thereof, with a wheel button switch, two mouse button switches and light emitting and receiving elements being mounted on the printed circuit board;

a cover covering said body, and provided with two mouse buttons corresponding to the two mouse button switches;

a wheel set between the light emitting and receiving elements, with two wheel shafts horizontally extending outward from center portions of both side surfaces of a central area of the wheel, with serrations formed around an external surface of a first one of the two wheel shafts at an inside portion of the wheel shaft, a plurality of openings and radial ribs alternately formed on the central area of the wheel at regular intervals;

a wheel base mounted on the body for rotatably supporting the first one of the two wheel shafts, and provided at a side surface of an upper portion thereof with a locking projection, said locking projection engaging with said serrations of the wheel, with a tension rib providing elasticity to the locking projection;

two support ribs upwardly extending from the bottom of the body, and spaced apart from each other by a predetermined

gap to rotatably support a second one of the two wheel shafts; and

a spring for upwardly biasing the wheel.

2. The mouse according to claim 1, wherein said wheel base comprises a shaft hole for receiving and supporting the first wheel shaft and two legs extending at both side ends of the wheel base, and said body comprises two leg holding ribs, said leg holding ribs upwardly extending from the bottom of the body and each having a fitting groove, whereby the wheel base is detachably mounted to the body.

3. The mouse according to claim 2, wherein a projecting piece is formed at a position of each of the leg holding ribs, and is provided on a top surface thereof with a spring seat groove, such that both ends of the spring held on the shaft are respectively seated in the spring seat grooves of the projecting pieces of the leg holding ribs, thus elastically and upwardly biasing the wheel.

4. The mouse according to claim 1, wherein support projections are provided on a surface of the wheel base at opposite ends such that the locking projection is positioned between the support projections, said support projections being in contact with a side surface of the wheel, thus

preventing an unexpected movement of the wheel.

5. A mouse with a wheel rotatably supported by wheel shafts, comprising:

serrations formed around an external surface of one of the wheel shafts at an inside portion of the wheel shaft;

a locking projection engaging with the serrations of the wheel and provided at a wheel shaft support member in such a way as to provide elasticity.

6. The mouse according to claim 5, wherein said locking projection is connected to an upper portion of the wheel shaft support member through a tension rib, thus providing the elasticity.

Application No: GB 0300179.9 **Examiner:** Terence Newhouse
Claims searched: 1,5 at least **Date of search:** 10 June 2003

Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	5	GB 2329695 A	(Cheng), see figs 2 & 4-6 noting serrations 39 on wheel shaft and projection 41 at support member 31
X	5	DE 29716864 U1	(Cheng), see also WPI Abstract Accession No. 1998-020529[03] and figs noting serrations 39, projection 41
X,Y,P	X 5,6 Y:1,4	DE 20207189 U1	(Kye), see also WPI Abstract Accession No. 2002-724797[79] and figs noting serrations 48 around shaft 46, projection 34, member 30
X	5	US 6340966 B1	(Wang), see figs 4-9 noting serrations 62 around shaft 61, projection 8, member 51
X	5	US 6348913 B1	(Kye), see figs 2-3 noting serrations 223 around shaft 221, projection 325 on tension rib, support member 30
Y	1,4	US 6353429 B1	(Microsoft), see figs 12 & 13 noting locking projection 120 on tension rib

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[V]:

F2Y

Worldwide search of patent documents classified in the following areas of the IPC[7]:

G06F

The following online and other databases have been used in the preparation of this search report :

EPODOC, JAPIO, WPI